

## **Review Guide to the National Science Content Standard D (Grades 9-12)**

- Origin and Evolution of the Earth System
- Origin and Evolution of the Universe

The website links below provide a wealth of information which reinforces the National Standards (Content Standard D) related to the origins of the Earth and universe. These scientific concepts are expected to be mastered after completion of a high school science program.

Fundamental concepts and principles that underlie this standard are highlighted in red.

### **THE ORIGIN AND EVOLUTION OF THE EARTH SYSTEM**

The sun, the earth, and the rest of the solar system formed from a nebular cloud of dust and gas 4.6 billion years ago. The early earth was very different from the planet we live on today.

- [http://liftoff.msfc.nasa.gov/academy/universe/b\\_bang.html](http://liftoff.msfc.nasa.gov/academy/universe/b_bang.html) (Big Bang Theory)
- <http://hepwww.rl.ac.uk/pub/bigbang/file1.html> (Exploring the Origins of the Universe)
- <http://itss.raytheon.com/cafe/qadir/acosmexp.html> (Frequently asked questions & answers regarding the formation of the universe)

Geologic time can be estimated by observing rock sequences and using fossils to correlate the sequences at various locations. Current methods include using the known decay rates of radioactive isotopes present in rocks to measure the time since the rock was formed.

- [http://library.thinkquest.org/3471/radioactive\\_dating.html](http://library.thinkquest.org/3471/radioactive_dating.html) (radioactive dating explained)
- <http://www.dc.peachnet.edu/~pgore/geology/geo102/radio.htm> (Radioactive decay of sample elements, graphs, etc.)
- <http://www.looksmart.com/r?page=/search/frames/index.html&isp=US&name=&bcolor=ffcc00&key=radioactive+dating&url=http%3a//pegasus.astro.umass.edu/a100/handouts/raddat/raddat.html&pskip=&nskip=15&se=0,0,7,0,1000&index=5> (Radioactive dating of non-terrestrial objects)

Interactions among the solid earth, the oceans, the atmosphere, and organisms have resulted in the ongoing evolution of the earth system. We can observe some changes such as earthquakes and volcanic eruptions on a human time scale, but many processes such as mountain building and plate movements take place over hundreds of millions of years.

- <http://cnews.tribune.com/quicktime/199705/earthquake-explain.mov> (How an earthquake occurs with animation and narration)
- <http://cnews.tribune.com/quicktime/199705/quake0512scale.mov> (Earthquake damage at corresponding values on the Richter scale.
- <http://cnews.tribune.com/news/image/0,1119,ktla-nation-31922,00.html> (Richter scale rating of recent quakes)
- <http://cnews.tribune.com/news/image/0,1119,ktla-nation-20828,00.html> (Earthquake explainer)

- <http://www.geo.mtu.edu/volcanoes/> (Michigan Technological University—Everything you ever wanted to know about volcanoes)
- <http://www.ksbe.edu/hawaii/ntgusher.mov> (Volcanic eruption-Hawaii)
- <http://www.altavista.com/cgi-bin/query?q=volcanic+eruption&vidset=1&stype=svideo&pg=q&vavi=1&vmpeg=1&vmov=1&vwin=1&vreal=1&vothr=1&mmdurrlt=1&mmdurrgt=1&mmW=1&mvc=0&vidset=1> (Volcanic eruption of Mount Usu, Hokkaido, Japan)

Evidence for one-celled forms of life--the bacteria--extends back more than 3.5 billion years. The evolution of life caused dramatic changes in the composition of the earth's atmosphere, which did not originally contain oxygen.

- <http://www.looksmart.com/r?page=/search/frames/index.html&isp=US&name=&bcolor=ffcc00&key=evidence+for+bacteria+evolution&url=http%3a//daphne.palomar.edu/evolve/evolve%5f3.htm&pskip=&nskip=15&se=3,0,0,0,1000&index=1> (Evidence for evolution)

## THE ORIGIN AND EVOLUTION OF THE UNIVERSE

The origin of the universe remains one of the greatest questions in science. The "big bang" theory places the origin between 10 and 20 billion years ago, when the universe began in a hot dense state; according to this theory, the universe has been expanding ever since

- <http://www.looksmart.com/r?page=/search/frames/index.html&isp=US&name=&bcolor=ffcc00&key=evidence+for+expanding+universe&url=http%3a//www.lbl.gov/Science%2dArticles/Archive/gerson%2dgoldhaber%2dsupernova.html&pskip=&nskip=15&se=3,0,1,0,1000&index=1> (Evidence for an expanding universe)
- <http://www.looksmart.com/r?page=/search/frames/index.html&isp=US&name=&bcolor=ffcc00&key=evidence+for+expanding+universe&url=http%3a//www.bergen.com/morenews/science20199807199.htm&pskip=&nskip=15&se=3,0,1,0,1000&index=3> (Case builds for an expanding universe)

Early in the history of the universe, matter, primarily the light atoms hydrogen and helium, clumped together by gravitational attraction to form countless trillions of stars. Billions of galaxies, each of which is a gravitationally bound cluster of billions of stars, now form most of the visible mass in the universe.

- [http://www.findarticles.com/cf\\_dls/m1200/22\\_157/62981025/p1/article.jhtml](http://www.findarticles.com/cf_dls/m1200/22_157/62981025/p1/article.jhtml) (All aglow in the early universe)

Stars produce energy from nuclear reactions, primarily the fusion of hydrogen to form helium. These and other processes in stars have led to the formation of all the other elements.

- <http://zebu.uoregon.edu/textbook/energygen.html> (Thermonuclear fusion of hydrogen to helium with animation and narration)
- <http://www.looksmart.com/r?page=/search/frames/index.html&isp=US&name=&bcolor=ffcc00&key=formation+of+the+elements+in+stars&url=http%3a//www.spacedaily.com/news/milkyway%2d00b.html&pskip=&nskip=15&se=3,0,1,0,1000&index=2> (Formation of elements heavier than iron)